(*b*) On the other hand, in the cortex surrounding the area referred to, old-standing optic atrophy causes no modification of the lamination.

(*c*) In anophthalmos the conjoined outer granule layer and line of Gennari (for the granules in the former layer are not sufficiently obvious to admit of easy micrometer measurement alone) are narrowed down to two-thirds of the normal thickness, the other layers of the cortex being approximately unchanged. This amount of narrowing is the same as that found in cases of old-standing optic atrophy.

(*d*) The majority of the layers of the cortex either inside or outside the area of special lamination do not vary appreciably in thickness as a result of age or chronic insanity, but there is an almost exact correspondence between the thickness of the conjoined first and second layers cf the cortex and the degree of amentia or dementia existing in the patient.

Summary of Conclusions drawn from the present Research.

(1) The area located and described in this paper is the primary visual region of the cortex cerebri.

(2) The part of this area to which afferent visual impressions primarily pass is the region of the line of Gennari.

(3) A marked contraction of the area in both extent and distribution, without absence of the line of Gennari, occurs in anophthalmos.

(4) This area can probably be described as the cortical projection of the corresponding halves of both retinæ. In this projection the part above the calcarine fissure represents the upper corresponding quadrants and the part below the lower corresponding quadrants of both retinæ.

"Underground Temperature at Oxford in the Year 1899, as determined by Five Platinum Resistance Thermometers." By ARTHUR A. RAMBAUT, M.A., D.Sc., Radcliffe Observer. Communicated by E. H. GRIFFITHS, F.R.S. Received May 17,—Read June 21, 1900.

(Abstract.)

I. *Description of the Apparatus.*

The instruments with which the earth-temperatures given in this paper were observed were five platinum resistance thermometers of the Callendar and Griffiths pattern.

The thermometers were inserted in undisturbed gravel, the first four

lying one under the other in a vertical plane beneath the grass of the south lawn of the Radcliffe Observatory, and within a few feet of the Stevenson's screen in which the dry bulb and the wet bulb, the maximum and minimum thermometers, are suspended. A fifth thermometer was subsequently placed at a depth of about 10 feet in a separate pit. The actual depths of the various thermometers as measured in October, 1898, were as follows :—

Thermometer.	I.	II.	III.	IV.	V.
Depth......	$6\frac{1}{2}$ in.	1 ft. 6 in.	3 ft. $6\frac{1}{2}$ in.	5 ft. $8\frac{1}{2}$ in.	9 ft. $11\frac{1}{2}$ in.

The resistance box is in its general design similar to that described by Mr. Griffiths,* but simplified to suit the particular class of work for which it was intended. It is provided with three principal coils, A, B, and C, whose nominal values are, 20, 40, and 80 box units respectively, a box unit being about 0·01 ohm.

The apparatus is provided with a slow motion contact maker, of Mr. Horace Darwin's pattern,† and Mr. Griffiths's thermo-electric key.‡

In the standardisation of the apparatus the method described by Mr. Griffiths, in his article in 'Nature,' referred to above, was in the main followed. The temperature coefficient was determined by Mr. Griffiths, in his own laboratory at Cambridge. Two separate series of observations led to the following results :—

Date.	Range of temperature.	Temperature coefficient.
July 27	9·18°	0·000242
August 8...........	12·51	0·000240

The value actually used in the reductions was 0·00024.

From observations made when the instrument was mounted *in situ* at Oxford, the values of the coils were found to be

$$\left.\begin{array}{l} C = 80{\cdot}158 \\ B = 39{\cdot}979 \\ A = 19{\cdot}863 \end{array}\right\}\text{mean box units,}$$

and one scale division of the bridge wire is equal to

1·0134 mean box units.

One of the most important considerations in connection with this subject is the degree of permanence in the fundamental points, as determined at considerable intervals of time; but the process of standardisation is not one that can be very frequently applied.

* 'Nature,' vol. 53, November 14, 1895.

† 'Nature,' vol. 53, November 14, 1895.

‡ 'Phil. Trans.,' A, pp. 397–8, vol. 184 (1893).

All the instruments were very carefully standardised by means of observations extending over three days, in October, 1898, and on October 6, 1899, taking advantage of a visit from Mr. Griffiths, I had the 6-in. thermometer dug up, and we examined its zero point after exactly a year's continuous observations. The readings agreed to within 0·004° C., being

In 1898	0·306
In 1899	0·302

For reasons given in the paper, it was not thought necessary to re-examine the boiling point. For another thermometer (A), kept in the observing room, the fundamental interval was found to have remained practically unchanged, being

In 1898	101·067
And in 1899	101·059

II. *Discussion of the Observations.*

The first step in the discussion of the observations is to group them into monthly means, and thence to deduce the harmonic expressions which will represent the readings of each thermometer throughout the year.* These monthly means expressed in degrees Fahrenheit are given in the following table :—

Mean Monthly Temperature of the Ground at the Radcliffe Observatory, Oxford, 1899.

Thermometer	1	2	3	4	5
Depth	6½ in.	1 ft. 6 in.	3 ft. 6½ in.	5 ft. 8½ in.	9 ft. 11½ in.
January	40·47°	42·07°	44·68°	46·80°	49·97°
February	40·09	41·34	43·25	45·08	48·33
March	41·34	41·91	43·21	44·74	47·42
April	48·77	47·66	46·61	46·40	47·37
May	54·86	52·95	50·96	49·54	48·53
June	66·73	62·89	58·29	54·73	50·88
July	69·43	65·93	62·15	58·74	53·85
August	69·23	67·79	64·88	61·66	56·39
September	59·34	61·12	62·03	61·19	57·80
October	48·99	51·14	54·29	56·12	56·71
November	46·73	48·43	50·99	52·69	54·48
December	38·14	41·08	45·35	48·58	52·33

* Professor W. Thomson, "On the Reduction of Observations of Underground Temperature," 'Trans. Roy. Soc. Edin.,' vol. 22, p. 409.

The harmonic expression to represent the temperature for any thermometer will be

$$\theta = a_0 + a_1 \cos \lambda t + a_2 \cos 2\lambda t + \&c.$$
$$+ b_1 \sin \lambda t + b_2 \sin 2\lambda t + \&c. \quad \ldots\ldots\ldots\ldots\ldots \quad (\text{C}),$$

or $$\theta = a_0 + \text{P}_1 \sin (\lambda t + \text{E}_1) + \text{P}_2 \sin (2\lambda t + \text{E}_2) + \quad \ldots\ldots\ldots\ldots \quad (\text{D}),$$

where t denotes the time represented as the fraction of the year, and λ is equal to 2π. From the monthly means given above we deduce the following :—

Values of the Coefficients.

No.	a_0	a_1	b_1	a_2	b_2	P	E_1	P_2	E_2
5	52°·005	−1°·970	−4°·706	−0°·068	+0·537	5°·102	202° 42′·8	0°·541	352° 45′·1
4	52·189	−6·379	−5·318	+0·661	+1·029	8·305	230 10·9	1·223	32 42·1
3	52·224	−9·467	−4·725	+1·370	+1·123	10·581	243 28·6	1·771	50 39·5
2	52·013	−12·932	−3·128	+2·130	+0·976	13·305	256 24·3	2·343	65 23·3
1	52·010	−15·337	−1·507	+3·017	+0·511	15·411	264 23·2	3·060	80 23·2
Air	50·396	−12·776	−1·621	+2·847	+1·410	12·878	262 46·1	3·177	63 39·2

From each wave as observed at any pair of thermometers we obtain two determinations of the diffusivity (k) of the gravel, one from the diminution of amplitude and the other from the retardation of phase.

In computing the value of the expression $\surd(\pi/k)$, the Paris foot and the Fahrenheit degree have been used.

I have omitted the results for the thermometer No. 1 (6 inches), which are too much affected by the diurnal changes and other causes. From six comparisons of the amplitude and retardation of the annual wave at the remaining four thermometers we obtain twelve determinations of the value of $\surd(\pi/k)$, the mean of which is 0·1189. For the half-yearly wave the mean value obtained in a similar way is 0·1187. This close agreement of the mean values of $\surd(\pi/k)$ derived from the annual and half-yearly waves is very remarkable, and seems to indicate a high degree of precision in the results.

The paper deals with the observations of a single year, and the results accordingly exhibit some discrepancies between theory and observations which, although they are less than might have been expected, are greater than one would like to see. These discrepancies are due partly to the fact that the temperature variations are not strictly of a periodic character, as the theory supposes, and as such they might be expected to be diminished in the mean of a number

of years, and partly to irregularities, physical and formal, in the surface of the ground.

Another source of irregularity affecting previous observations of this sort, namely, thermometer errors arising from the uncertainty as to the temperature of the liquid in the long stems of the mercury or alcohol thermometers, does not in this case apply; and if other errors peculiar to the platinum thermometers exist, they seem to be confined within much smaller limits.

"On the Kinetic Accumulation of Stress, illustrated by the Theory of Impulsive Torsion." By KARL PEARSON, F.R.S., Professor of Applied Mechanics, University College, London. Received May 29,—Read June 21, 1900.

(Abstract.)

1. It is usual in engineering practice to double the value of the stresses, calculated statically, when a live load comes onto a girder; and further various empirical laws, such as those due to Wöhler, are adopted in the case of repeated loading to measure the effective resistance of a structure. While these methods, practically adopted, show very clearly that there is a just appreciation that loading varying with the time differs in its nature very considerably from purely permanent loading, they yet fall considerably short of the definiteness required from the theoretical standpoint. Occasionally it must be confessed that they would fail even from the practical standpoint were it not for the large factor of safety usually adopted.

So soon as a live load comes onto a girder, even without impulse, vibrational terms arise in the strains, and the same thing occurs also in the parts of machinery subjected to external forces changing with the time. The discussion of the strains in a girder due to a rolling load was first undertaken by Sir George Stokes in 1849,* and his results have been considerably extended in later papers by Phillips, Renaudot, Bresse, and de Saint-Venant.† The latter has further dealt with a considerable number of problems of what I have elsewhere termed *non-impulsive resilience*,‡ as well as a variety of cases of impulsive resilience in the case of bars receiving longitudinal or transverse impacts.§ The numerical results of Saint-Venant's papers, as well as his graphical representations, hardly seem

* See 'History of Elasticity,' vol. 1, arts. 1276 and 1417.

† *Loc. cit.*, vol. 2, arts. 372—382.

‡ *Loc. cit.*, vol. 2, arts. 355—357.

§ *Loc. cit.*, vol. 2, arts 401—414. (For the history of the subject see art. 341.)